REMARKS

Applicants acknowledge the indication of the allowability of the subject matter of Claim 14, as set forth on page 7 of the Office Action. In particular, the latter claim would be allowable if rewritten in independent form. By the foregoing amendment, that has been done. Accordingly, Claim 14 is now believed to be allowable.

The objection to Claim 10 as set forth on page 2 of the Office Action has been rendered moot by the cancellation of Claim 10.

Claims 1-7, 9-13, 15-18, 21, 24-28 and 30-44 (all claims remaining of record other than Claim 14) have been rejected under 35 U.S.C. §103(a) as unpatentable over Bilgen et al (German patent document DE 198 39 383, which corresponds to U.S. Patent No. 6,458,226 in view of Hathaway (U.S. Patent No. 2,261,878) and Fritz et al (NPL "*Fertigungs Technik*", 1995, and the English translation for Figures 5-24 and 5-26). By the foregoing amendment, independent Claims 1 and 25 and dependent Claims 2-7, 9-15, 18, 21 and 25 have been cancelled. (Claims 8, 19 and 20 having been cancelled previously.) Accordingly, Claims 14, 16, 17, 24, 26-28 and 30-44 remain pending in this application, with Claims 14 and 26 being the only remaining independent claims (Claim 14 having been indicated to be allowable as noted previously). For the reasons set forth hereinafter, Applicants respectfully submit that all claims

which remain of record in this application, distinguish over the cited prior art and are allowable.

The present invention as defined in Claim 26, is directed to a method for hot forming a steel coil spring or stabilizer by means of a technique which includes deforming a round steel rod in a single deforming step coordinated with heat treatment of the steel rod in a particular manner described hereinafter; reheating the rod to a temperature above Ac3; hot forming the rod to form a coil spring or bending it into a stabilizer; and hardening and temping the wound or bent rods.

As further specified in Claim 26, the single deforming step, coordinated with heat treatment includes heating the rod to a heating temperature that is above its recrystallization temperature and deforming it by skew rolling, such that a predetermined twisting of the material occurs in a marginal area of the steel rod, and a desired deformation gradient is achieved over a cross section of the rod, so that, after a critical degree of deformation is exceeded, dynamic recrystallization processes take place with the greatest intensity in the marginal areas.

According to the present invention the combination of such a single deforming step, including skew rolling at an elevated temperature, combined with the subsequent reheating of the rod to a temperature above Ac3 and

thereafter hot winding it to form a coil spring or bending it to form a stabilizer after recrystallization has taken place, achieves advantages not previously known from the prior art. In particular, the hot forming processing according to the invention achieves a distribution of structures over the cross section of the rods, in which the immediate marginal zone has fine-grained martensite structure of high strength. The marginal area has a continuous structure extending at an angle to the axis of the rod, with the direction of twist corresponding to the main direction of tension of a torsionally stressed component, such as coil spring. The mixed pearlite-martensite structure of the characteristic zone is coarser than the structure in the marginal area and exhibits no twisting phenomena. (See specification, page 7, lines 11-18.)

Thus, by an appropriate selection of the rolling parameters, as described in the specification, a critical degree of deformation is achieved by a single rolling process, so that ultimately a gradient of the degree of crystallization from the outside of the rod to the inside results. When the rod is subsequently reheated, wound into a coil spring or bent into a stabilizer, and then hardened and tempered, the marginal zone (near the surface of the rod) has such a martensite structure. (See, for example, specification at page 4, lines 1-15.)

The primary Bilgen et al patent, on the other hand, discloses a process for thermomechanical treatment of steel which includes inductive heating of a

starting material such as spring steel, austenitizing the product, holding its temperature for a short time, forming the material into a formed product at a temperature above the recrystallization temperature, quenching to martensite and tempering. However, the Bilgen et al patent does not teach or suggest the provision of a hot forming process which combines two steps, the first step being a single deforming step, coordinated with heat treatment of the steel rod, utilizing a skew rolling technique, followed by reheating the rods to a temperature above Ac3 and hot forming them into a coil spring or a stabilizer. It is this latter combination of steps, which is previously unknown, and which yields the heretofore unknown advantages of the present invention.

The Bilgen et al patent, in fact, differs fundamentally from the present invention, in that, to the extent that it addresses the manufacture of springs, it is directed to the production of cold rolled coil springs, and not to the production of hot formed coil springs, as is the process according to the present invention. In this regard, Applicants refer to Column 3, lines 5-11 of the Bilgen et al patent, which notes that the martensite microstructure formed after quenching may be further refined by re-austenitizing quickly, and that the resulting austenite in turn is requenched after further forming, or even without forming. In addition, this portion of the disclosure also notes that "cold working before or after tempering is equally possible". However, it is important to consider in this regard, that if a coil spring in particular were formed between the first and

second heating steps, such a subsequent heating of the completely shaped coil spring to austenite temperature would inevitably result in a change of shape of the spring. Thus, it is apparent that a coil spring cannot have been formed after the first hardening and before the re-austenitizing. Moreover, cold forming can no longer be carried out on a completely shaped coil spring. Thus, it is apparent that, to the extent that the Bilgen et al patent is directed to the forming of a coil spring, it anticipates cold working of the spring, and not hot forming.

Moreover, because the Bilgen et al reference does not utilize skew rolling, it does not teach or suggest to a person skilled in the art the achievement of the advantages noted previously, which accrue from a combination of a single skew rolling step coupled with heat treatment, followed by a hot forming step with the material reheated to a temperature above Ac3. Indeed, to the extent that Bilgen et al refers to cold working of a coil spring, the process disclosed is incompatible with the present invention as defined in Claim 26.

The thermomechanical treatment process disclosed in Bilgen et al is summarized at Column 3, lines 31-48. On the one hand, four forming steps are discussed which, as noted at Column 2, line 59, are carried out with a forming degree of at least 0.1 (so that a change of the wire diameter is effected). After the forming steps, a brief holding time is provided before hardening. It is noteworthy in this regard, however, that no forming step is mentioned in order to

obtain a spring shape, particularly a coil spring or a stabilizer, as defined in the present invention.

The Office Action at page 4 cites the Hathaway patent as disclosing steps of rolling and winding to form a coil spring, and notes further that, as evidenced by the cited NPL-1 document and as discussed in Applicants' previous comments) skew rolling is a well known technique.

While Applicants take issue with neither of the latter propositions, they respectfully submit that none of the cited prior art documents teaches or suggests the combination of a single skew rolling step coordinated with heat treatment, followed by hot forming in order to achieve the advantages yielded by the present invention. Accordingly, Applicants that Claim 26, and therefore all claims of record distinguish over the cited references.

In light of the foregoing remarks, this application should be in condition for allowance, and early passage of this case to issue is respectfully requested. If there are any questions regarding this amendment or the application in general, a telephone call to the undersigned would be appreciated since this should expedite the prosecution of the application for all concerned.

If necessary to effect a timely response, this paper should be considered as a petition for an Extension of Time sufficient to effect a timely response, and please charge any deficiency in fees or credit any overpayments to Deposit Account No. 05-1323, Docket No. 103020.59950US.

Respectfully submitted,

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